AEI Consultants

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April 30, 2018

Ms. Kimberly Tisa
Mr. Frank Battaglia
US EPA Region 1
5 Post Office Square, Suite 100
Boston, MA 02109-3912

RE: Responses to Comments - Corrective Measures Implementation Work Plan
BASF Former Ciba-Geigy Facility
180 Mill Street
Cranston, Rhode Island
AEI Project No. 363655

Dear Kim and Frank:

On behalf of BASF Corporation (BASF), AEI has prepared the attached revised pages of the Corrective Measures Implementation (CMI) Work Plan (WP) dated March 22, 2018 in response to the comments offered by EPA during a conference call with BASF and AEI on April 26, 2018. The purpose of this letter is to submit those revised pages for insert into the CMI WP and thereby establish that document as final and approved by EPA. The specific pages being submitted, and itemized responses to EPA comments, are listed below.

Comment 1 – EPA noted that on page 8 of the CMI WP that use of the Site for public recreational use was still in this version, which seemed contrary to previous e-mails.

> Response: It was agreed that this issue will be addressed in the ELUR, which will specify the actual Site uses that will be allowed (passive recreational activities, open space, and/or parking lot). Page 8 was not revised.

Comment 2: On page 31 of the CMI WP (Section 4.2.1.9), EPA noted an issue moving excess grading material with PCB concentrations <10 mg/kg.

> Response: This section was changed to: "...excess grading material from Lot 1102 with PCB levels < 1 mg/kg,". Revised Page 31 is attached.

Comment 3: On page 34 of the CMI WP (Section 4.2.4.1) EPA noted that soil sampling for PCBs from the sidewall of the excavation which will be treated via ISCO groundwater treatment will be completed to show compliance with the PCB soil remedial objectives, which is not applicable to the ISCO treatment.

Response: This section was revised as follows: "The water (and water with detergent) will be poured onto the ground if it contains less than 0.5 ug/l PCBs. Pesticide-grade solvents will be disposed of according to TSCA disposal regulations." The revised Page 140 is attached.

Comment 10: On page 18 of Appendix F (Section 4.1) EPA noted that this section states that samples would be collected on a frequency of 1 sample per every 25 linear feet, instead of every 5 feet.

Response: AEI notes that the TSCA regulations do not specify or require excavation sidewall samples. Regulation 40 CFR 761.283 (b) references sampling based on a two-dimensional grid, and this fact is now addressed for the excavation bottom by adding the sentence: "Bottom samples will be collected at the nodes of a 5 foot grid." (These samples were already included on Table 4-1). However, it is technically impractical to create and sample a 5-foot grid on the sidewall of an excavation. Therefore, AEI intends to follow RIDEM guidelines (Policy Memo 2012-01), where sidewall samples will be located so at least one sample per sidewall is collected in an excavation that is 4 feet deep, or less. Frequency would be one sample per 25 linear feet of sidewall. For excavations deeper than 4 feet, at least one additional sample will be collected below each shallow sidewall sample. The revised Page 18 of Appendix F is attached.

AEI has attached copies of the corrected pages noted above all with and without tracked changes, as well as the cover sheet of the CMI Work Plan, with today's date. Please let us know if you have any questions. Thanks,

Sincerely,

AEI Consultants

Richard G. Kowalski
Senior Project Manager

Stephen J. Graham, PE, LSP
Executive Vice President

Attachments: Revised CMI WP and Appendix F pages (clean and tracked changes versions)
Revised Dexsil Method SOP

CC: Joseph Guarnaccia, BASF

AEI Consultants

April 30, 2018

CORRECTIVE MEASURES IMPLEMENTATION WORK PLAN:
Soil Remedy for Former Production Area (Lot 1102)

Property Identification:

BASF Former Ciba-Geigy Facility
180 Mill Street
Cranston, Rhode Island

AEI Project No. 363655

Prepared for:

BASF Corporation
100 Park Avenue
Florham Park, New Jersey 07932

Prepared by:

AEI Consultants
112 Water Street, 5th Floor
Boston, Massachusetts 02109

Gordon R. Archibald, Inc.
200 Main Street
Pawtucket, Rhode Island

soils to be removed within the next twelve (12) months, while the full groundwater remedy proceeds in parallel over a longer period of time.

Consistent with the Project Scoping Documents, the Proposed Remedial Actions for the Site are described as follows:

Soil

Removal Actions

- Removal and off-site disposal, at an approved facility, of all soil impacted with PCB greater than or equal to 25 mg/kg, and, as necessary, additional soil with PCB content greater than or equal to 10 mg/kg, such that the resulting Exposure Point Concentration, as calculated by the 95% Upper Confidence Level, is less than 10 mg/kg.
- For the Floodway Area (**Figure 2**) along the river margin, which will not be covered in the manner described in the Final Remedial Activities below, PCB-impacted soils with concentrations greater than or equal to 1 mg/kg will be removed, and the excavations backfilled with clean backfill materials to existing grade, or lower. Wetland soil type and vegetative species will be installed in portions of the Floodway Area.
- Implement a TSCA approvable post-excavation verification sampling plan to verify that the cleanup metrics are achieved.

Final Remedial Activities

- After the removal actions described above are complete, install a 2-ft clean soil cover over all areas where greater than or equal to 1 mg/kg PCBs remains to limit both direct contact and leaching potential. The clean soil cover will include an impermeable high-density polyethylene (HDPE) cover material (e.g. Nilex 40 mil HDPE, or equivalent) over areas with PCB concentrations greater than 10 mg/kg and where intervening concrete slabs are not present for leaching control, and the entire area (except for the sewer easement) will be covered by a permeable geotextile barrier (e.g., Mirafi 180N or equivalent). Once placed, the HDPE cover material will function as an impediment to water infiltration and the geotextile barrier will act as an impediment/indicator to unapproved invasive activity. The geotextile material will be covered with 2-feet of certified clean soil or equivalent (e.g., crushed stone may be used in areas where 2-feet of soil cannot be placed due to flood storage considerations, as in Floodway Zone AE (see **Figure 2**) per Federal Emergency Management Agency (FEMA) and RIDEM Wetland regulations, to support landscaping alternatives, and as an additional engineered impediment to potential future unapproved invasive activity). This clean soil cover configuration will eliminate the risk to humans of direct contact with impacted soil and limit the potential for dissolved-phase migration and thereby meet the requirements for an alternative TSCA risk-based closure under 40 CFR Part 761.61 (c) and RIDEM Remedial Regulations.

- The area of the FEMA Floodway that is not designated for excavation will be sampled to confirm compliance, as detailed in the Sampling and Analysis Plan (**Appendix F**) which shows the proposed locations of seven borings on Figure F-1 (B-896 thru 892) which will be sampled from 0-2 ft bgs for PCBs, SVOCs, pesticides, metals and cyanide, as shown on Tables 4-1 and 5-1.

Because at location SWMU 11 and SWMU-8, VOC-impacted soils are comingled with PCBs, VOCs will also be sampled from the sidewalls of the excavation (one per sidewall) and analyzed per EPA Method 8260C. VOC compliance will be achieved when the soils from the unsaturated zone exhibit concentrations below the RIDEM GB Leachability standard of 54 mg/kg (ppm) toluene and 100 mg/kg chlorobenzene; the toluene and chlorobenzene parameters are being used as an action threshold, because the other VOCs of concern, which have been encountered in the soils or groundwater historically, do not have GB criteria. These other VOCs include 1,2-dichlorobenzene, 2-chlorotoluene, and xylenes. The compliance program for groundwater remediation will be defined in a separate CMI planned to occur after the pilot ISCO programs are completed.

4.2.1.9 Backfill

Backfill operations are proposed to commence following verification of regulatory-compliant post-excavation analytical results. On-Site backfill sources proposed are the excavation of the FEMA Floodway to remove soils > 1 mg/kg PCBs, where the soil is <10 mg/kg; the stockpiled material from the 2016 RAWP conducted on adjacent Lots 1108 and 2630, which contains low-level PAHs and PCBs (<10 mg/kg); and other excess grading material from Lot 1102 with PCB levels < 1 mg/kg. Backfill material will not contain >= 10 mg/kg PCBs. The PCB data for the stockpiled soil from Lots 1108 and 2630 is presented in **Attachment 4**.

Off-Site fill material will be needed in the FEMA Floodway to restore grades to original conditions and to install the final clean soil covering outside the FEMA Floodway and landscaping activities. Fill material may include common borrow, topsoil and wetland topsoil (for the FEMA Floodway only). Material compliance shall follow RIDEM remediation standards as described in Design Technical Specification **31 70 00 Analytical Testing Requirements for Imported Soil.**

Backfilled areas will be raised no higher than an elevation 2-feet below the final grades as designated on **Contract Drawing C-7, Final Grading Plan.**

4.2.2 Clean Soil Cover

After the soil excavation is complete, in areas where known PCB concentrations are equal to or above 1 mg/kg, a RIDEM-approved clean soil cover will be installed, i.e., 2-foot clean soil or equivalent over a layer of permeable geotextile (e.g., crushed stone may be used in areas where

design will be submitted under a separate CMI work plan. At this time, because the remedial action proposed for the SMWU-11 area is linked to the soil remedy through excavation (**Section 4.2.1.4**), this component is detailed in this CMI WP for approval

4.2.4.1 Residual Upland Groundwater Contamination

For impacted groundwater in the vicinity of SWMU-11, ISCO applied via mixing is proposed to achieve compliance. As discussed in **Section 4.2.1.4**, once the VOC-impacted soils above the water table are removed, a chemical oxidant (proposed sodium persulfate) will be added into the open excavation and mixed into the remaining saturated zone soils in the bottom of the excavation. Soils will be blended by mechanical means. The persulfate addition and blending is proposed to treat in-situ the residual VOC soil contamination remaining at the bottom of the excavation. The envisioned sequencing will proceed by removing approximately one-quarter of the target SWMU-11 area at a time. Once one soil quadrant is excavated, and the top of groundwater is reached, sidewall sampling as discussed in **Section 4.2.1.8**, will be conducted to show compliance with the VOC and PCB remedial objectives. ISCO reagent will then be lowered down via backhoe bucket into the exposed groundwater. The bucket will mechanically mix the reagent (1,250 gallons of a 5% to 7% Catalyzed Sodium Persulfate solution or equivalent per quadrant) in the exposed groundwater. Mixing will occur as deep as practical with the available equipment, but not less than 2 feet into the saturated zone. After mixing has been completed, backfill containing < 10 mg/kg PCBs will be placed into the excavation until grade is re-established. This process will be repeated until each of the four quadrants of SWMU-11 is remediated.

4.2.4.2 COC Migration Control

In accordance with the 2016 AECOM CMS and draft SOB (EPA 2016), an ozone ISCO reactive barrier system will be installed parallel to the river bulkhead and normal to the groundwater flow direction to destroy VOC mass in-situ before it migrates off-Site and discharges to the Pawtuxet River. The full in-situ reactive barrier is being separately scoped and designed by others. The proposed oxidant is ozone, and it will be applied to the aquifer in a continuous fashion using a line of wells that overlap in their volume of influence (a sparge application). The remedy will commence as a pilot operation and may need to be run for several years until such time as upgradient and downgradient monitoring show that the media protection standards have been met. The remedy design including the treatment volume, number and orientation of injection wells, and monitoring requirements will be determined from a pilot testing program.

AEI Consultants

April 30, 2018

SAMPLING AND ANALYSIS PLAN (SAP)

Property Identification:
Former Ciba-Geigy Facility
180 Mill Street
Cranston, Rhode Island

Prepared for:
BASF Corporation
100 Park Avenue
Florham Park, New Jersey

Prepared by:
AEI Consultants
112 Water Street, 5th Floor
Boston, Massachusetts

Environmental Due Diligence

Building Assessments

Site Investigation & Remediation

Energy Performance & Benchmarking

Industrial Hygiene

Construction Risk Management

Zoning Analysis Reports & ALTA Surveys

4.0 SAMPLING RATIONALE

Sampling of soil and groundwater will be conducted at the conclusion of each remedial phase, except for soil capping, to verify compliance with the cleanup standards in **Tables 3-1a** and **3-1b**. At this time, the groundwater remedy is in the design phase and an Initial Production Task (IPT) will be completed prior to the completion of the full design. This SAP includes the groundwater progress monitoring sampling proposed for the IPT.

4.1 Soil Sampling

Soil removal and disposal (R&D) will occur prior to soil sampling. Soil sample collection will be conducted by AEI field staff. Soil sample results will be used to show compliance with the cleanup standards. Excavation areas and proposed points of compliance are shown on **Figures 1** and **2.** Bottom samples will be collected at the nodes of a 5 foot grid. Sidewall samples are not shown and will be determined in the field by the AEI field staff based upon final excavation area. Sidewall samples will be located so at least one sample per sidewall is collected. Frequency will be 1 sample per every 25 linear feet. For excavations deeper than 4 feet, at least one additional sample will be collected below each shallow sidewall sample. **Table 4-1** provides information regarding the sample designation, proposed sample depths, sample/duplicate/QC rationale. Sidewall sample depths are to be determined based upon final excavation extents.

4.2 Sediment Sampling

Not applicable to this scope of work

4.3 Groundwater Sampling

An IPT will be performed as part of the groundwater treatment pilot study. Following the IPT, progress monitoring of the VOC contamination in site groundwater will be conducted by AEI. Deep and shallow groundwater will be evaluated using existing on-Site wells. The proposed compliance wells are shown on **Figure 3**. **Table 4-2** provides sample designation, sample depth, sample locations/duplicate information.

4.4 Other Sampling

Samples for disposal characterization purposes may need to be collected during the course of work. Frequency of sampling will be specified by the selected disposal facility, but for this project it is anticipated the required sample frequency will be one (1) sample for every 500 tons of material. When collecting soil samples for disposal purposes, the disposal parameters for approval shall be used as the analytical requirements. These analyses may include: VOCs, PCBs, SVOCs, TPH, RCRA 8 Metals, Reactivity, Ignitability, Paint Filter, and Total Cyanide and Sulfur.

Table 4-1: Soil Sampling Design and Rationale

Sampling Location/ID Number	Depth (ft)	Analytical Parameter	Rationale
Bottom Samples			
B-1	1	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-2	1	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-3	1	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-4	1	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-5	3	PCBs (9078, 8082A)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-6	3	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-7	3	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-8	3	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-9	3	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-10	3	PCBs (9078, 8082A)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-11	3	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-12	3	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-13	3	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-14	3	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-15	3	PCBs (9078, 8082A)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-16	3	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-17	3	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.

for each sample. If the results are found to be acceptable, AEI will determine if the use of a multiplier for the field screening results will be necessary to assure that false negatives are eliminated (i.e., soils that actually contain >25 mg/kg aren't identified as <25 mg/kg soils). (See Attachment 3 of the CMI WP for results of the Comparability Study and for the attached SOP developed for use of the Dexsil method).

Once the PCB screening method has been shown to be acceptable for use, it will be employed to show compliance with the 25 mg/kg cleanup level during excavation activities. Areas where the cleanup level is less (i.e., Floodway, where cleanup must achieve < 1 ppm), AEI will utilize laboratory analyses only when the extent of the excavation has been achieved. However, the Dexsil method will also be used in this area during the excavation process to guide the extent of excavation required. For every ten (10) PCB screening samples collected and analyzed by the Dexsil L2000DX PCB/Chloride analyzer, two (2) soil samples will be submitted to the laboratory for PCB analysis via EPA Method 8082A/3540C Soxhlet Extraction to verify the field screening results.

Additionally, field screening for VOCs using PID instrumentation and visual observations will be used by the field team to evaluate and adjust excavation depths and locations as needed, specifically in the areas of SWMU-8 and 11, but in others also, as needed. This approach to the field investigation is a key component of a dynamic CMI.

6.3 Soil

6.3.1 Surface Soil Sampling

Not Applicable, soil samples are to be collected from the final excavations which are greater or equal in depth than 6-12 inches below the ground surface.

6.3.2 Subsurface Soil Sampling

The majority of the soil sampling will be conducted below the ground surface at depths equal to or exceeding 12 inches. Sample depths will be achieved through contaminated soil removal as designed in the CMI WP. Refer to Section B.2.2 in the QAPP for soil sampling SOPs. The locations, except for sidewall samples, and sample designations are shown on **Figures 1** and **2** and the rationale given in **Table 4-1**.

Samples to be analyzed for VOCs will be collected first. Subsurface samples will be collected by hand at the desired sample depth once soil removal is complete. Once the desired sample depth is reached, soil samples for VOC analyses will be collected as independent, discrete samples. The top 6-inches of soil should be removed to encounter an "undisturbed" layer. Surface soil samples will be collected using the laboratory supplied Encore sampler, and will be collected in triplicate (one high-level and two low-level VOAs). Samples will be placed, sealed and properly stored in the pre-preserved laboratory sample jars. See Section 7.1 for shipping procedures.

Subsurface samples will be collected by manual methods (i.e., trowel) to the desired sample depth. Once the desired sample depth is reached, the AEI field staff, will collect a sample from the sidewall and bottom of the excavations. Sidewall samples will be collected as composites from the bottom to the top of the sidewall from depths of 0 to 4 ft bgs and from 4 to 8 ft bgs (or less), as necessary. AEI field staff are not to enter an excavation deeper than 4-feet and

8.0 DISPOSAL OF RESIDUAL MATERIALS

In the process of collecting environmental samples, the sampling team will generate different types of potentially contaminated IDW that include the following:

- Used personal protective equipment (PPE)
- Disposable sampling equipment
- Decontamination fluids
- Purged groundwater and excess groundwater collected for sample container filling

The EPA's National Contingency Plan (NCP) requires that management of IDW generated during sampling comply with all applicable or relevant and appropriate requirements (ARARs) to the extent practicable. In addition, other legal and practical considerations that may affect the handling of IDW will be considered.

- Used PPE and disposable equipment that does not come into contact with PCB-impacted soils will be double bagged and placed in a municipal refuse dumpster. These wastes are not considered hazardous and can be sent to a municipal landfill. Any PPE and disposable equipment that is to be disposed of which can still be reused will be rendered inoperable before disposal in the refuse dumpster. If PPE comes into contact with PCB soils, then disposal shall include placing the materials into 55-gallon drums and dispose of according to TSCA disposal regulations.

- Decontamination fluids that will be generated in the sampling event will consist of pesticide-grade solvent, deionized water, residual contaminants, and water with non-phosphate detergent. The volume and concentration of the decontamination fluid will be sufficiently low to allow disposal at the site or sampling area. The water (and water with detergent) will be poured onto the ground if it contains less than 0.5 ug/l PCBs. Pesticide-grade solvents will be disposed of according to TSCA disposal regulations.

- Purged groundwater will be landscaped should screening using a PID exhibit total VOC concentrations below 5.0 ppm. Otherwise, the purged water will be placed into a 55-gallon drum for disposal as non-hazardous liquid waste.

ATTACHMENT 2

Revised CMI WP and Appendix F Pages (Tracked Changes)

soils to be removed within the next twelve (12) months, while the full groundwater remedy proceeds in parallel over a longer period of time.

Consistent with the Project Scoping Documents, the Proposed Remedial Actions for the Site are described as follows:

Soil

Removal Actions

- Removal and off-site disposal, at an approved facility, of all soil impacted with PCB greater than or equal to 25 mg/kg, and, as necessary, additional soil with PCB content greater than or equal to 10 mg/kg, such that the resulting Exposure Point Concentration, as calculated by the 95% Upper Confidence Level, is less than 10 mg/kg.
- For the Floodway Area (**Figure 2**) along the river margin, which will not be covered in the manner described in the Final Remedial Activities below, PCB-impacted soils with concentrations greater than or equal to 1 mg/kg will be removed, and the excavations backfilled with clean backfill materials to existing grade, or lower. Wetland soil type and vegetative species will be installed in portions of the Floodway Area.
- Implement a TSCA approvable post-excavation verification sampling plan to verify that the cleanup metrics are achieved.

Final Remedial Activities

- After the removal actions described above are complete, install a 2-ft clean soil cover over all areas where greater than or equal to 1 mg/kg PCBs remains to limit both direct contact and leaching potential. The clean soil cover will include an impermeable high-density polyethylene (HDPE) cover material (e.g. Nilex 40 mil HDPE, or equivalent) over areas with PCB concentrations greater than 10 mg/kg and where intervening concrete slabs are not present for leaching control, and the entire area (except for the sewer easement) will be covered by a permeable geotextile barrier (e.g., Mirafi 180N or equivalent). Once placed, the HDPE cover material will function as an impediment to water infiltration and the geotextile barrier will act as an impediment/indicator to unapproved invasive activity. The geotextile material will be covered with 2-feet of certified clean soil or equivalent (e.g., crushed stone may be used in areas where 2-feet of soil cannot be placed due to flood storage considerations, as in Floodway Zone AE (see **Figure 2**) per Federal Emergency Management Agency (FEMA) and RIDEM Wetland regulations, to support landscaping alternatives, and as an additional engineered impediment to potential future unapproved invasive activity). This clean soil cover configuration will eliminate the risk to humans of direct contact with impacted soil and limit the potential for dissolved-phase migration and thereby meet the requirements for an alternative TSCA risk-based closure under 40 CFR Part 761.61 (c) and RIDEM Remedial Regulations.

- The area of the FEMA Floodway that is not designated for excavation will be sampled to confirm compliance, as detailed in the Sampling and Analysis Plan (**Appendix F**) which shows the proposed locations of seven borings on Figure F-1 (B-896 thru 892) which will be sampled from 0-2 ft bgs for PCBs, SVOCs, pesticides, metals and cyanide, as shown on Tables 4-1 and 5-1.

Because at location SWMU 11 and SWMU-8, VOC-impacted soils are comingled with PCBs, VOCs will also be sampled from the sidewalls of the excavation (one per sidewall) and analyzed per EPA Method 8260C. VOC compliance will be achieved when the soils from the unsaturated zone exhibit concentrations below the RIDEM GB Leachability standard of 54 mg/kg (ppm) toluene and 100 mg/kg chlorobenzene; the toluene and chlorobenzene parameters are being used as an action threshold, because the other VOCs of concern, which have been encountered in the soils or groundwater historically, do not have GB criteria. These other VOCs include 1,2-dichlorobenzene, 2-chlorotoluene, and xylenes. The compliance program for groundwater remediation will be defined in a separate CMI planned to occur after the pilot ISCO programs are completed.

4.2.1.9 Backfill

Backfill operations are proposed to commence following verification of regulatory-compliant post-excavation analytical results. On-Site backfill sources proposed are the excavation of the FEMA Floodway to remove soils > 1 mg/kg PCBs, where the soil is <10 mg/kg; the stockpiled material from the 2016 RAWP conducted on adjacent Lots 1108 and 2630, which contains low-level PAHs and PCBs (<10 mg/kg); and other excess grading material from Lot 1102 with PCB levels < ~~1~~10 mg/kg. Backfill material will not contain >= 10 mg/kg PCBs. The PCB data for the stockpiled soil from Lots 1108 and 2630 is presented in **Attachment 4**.

Off-Site fill material will be needed in the FEMA Floodway to restore grades to original conditions and to install the final clean soil covering outside the FEMA Floodway and landscaping activities. Fill material may include common borrow, topsoil and wetland topsoil (for the FEMA Floodway only). Material compliance shall follow RIDEM remediation standards as described in Design Technical Specification **31 70 00 Analytical Testing Requirements for Imported Soil**.

Backfilled areas will be raised no higher than an elevation 2-feet below the final grades as designated on **Contract Drawing C-7, Final Grading Plan**.

4.2.2 Clean Soil Cover

After the soil excavation is complete, in areas where known PCB concentrations are equal to or above 1 mg/kg, a RIDEM-approved clean soil cover will be installed, i.e., 2-foot clean soil or equivalent over a layer of permeable geotextile (e.g., crushed stone may be used in areas where

design will be submitted under a separate CMI work plan. At this time, because the remedial action proposed for the SMWU-11 area is linked to the soil remedy through excavation (**Section 4.2.1.4**), this component is detailed in this CMI WP for approval

4.2.4.1 Residual Upland Groundwater Contamination

For impacted groundwater in the vicinity of SWMU-11, ISCO applied via mixing is proposed to achieve compliance. As discussed in **Section 4.2.1.4**, once the VOC-impacted soils above the water table are removed, a chemical oxidant (proposed sodium persulfate) will be added into the open excavation and mixed into the remaining saturated zone soils in the bottom of the excavation. Soils will be blended by mechanical means. The persulfate addition and blending is proposed to treat in-situ the residual VOC soil contamination remaining at the bottom of the excavation. The envisioned sequencing will proceed by removing approximately one-quarter of the target SWMU-11 area at a time. Once one soil quadrant is excavated, and the top of groundwater is reached, sidewall sampling as discussed in **Section 4.2.1.8**, will be conducted to show compliance with the VOC and PCB remedial objectives. ISCO reagent will then be lowered down via backhoe bucket into the exposed groundwater. The bucket will mechanically mix the reagent (1,250 gallons of a 5% to 7% Catalyzed Sodium Persulfate solution or equivalent per quadrant) in the exposed groundwater. Mixing will occur as deep as practical with the available equipment, but not less than 2 feet into the saturated zone. After mixing has been completed, ~~sidewall sampling as discussed in **Section 4.2.1.8**, will be conducted to show compliance with the VOC and PCB remedial objectives in this area. Once achieving the VOC and PCB metrics,~~ backfill containing < 10 mg/kg PCBs will be placed into the excavation until grade is re-established. This process will be repeated until each of the four quadrants of SWMU-11 is remediated.

4.2.4.2 COC Migration Control

In accordance with the 2016 AECOM CMS and draft SOB (EPA 2016), an ozone ISCO reactive barrier system will be installed parallel to the river bulkhead and normal to the groundwater flow direction to destroy VOC mass in-situ before it migrates off-Site and discharges to the Pawtuxet River. The full in-situ reactive barrier is being separately scoped and designed by others. The proposed oxidant is ozone, and it will be applied to the aquifer in a continuous fashion using a line of wells that overlap in their volume of influence (a sparge application). The remedy will commence as a pilot operation and may need to be run for several years until such time as upgradient and downgradient monitoring show that the media protection standards have been met. The remedy design including the treatment volume, number and orientation of injection wells, and monitoring requirements will be determined from a pilot testing program.

AEI Consultants

~~September 7, 2017~~April 30, 2018

SAMPLING AND ANALYSIS PLAN (SAP)

Property Identification:
Former Ciba-Geigy Facility
180 Mill Street
Cranston, Rhode Island

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Prepared by:
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Environmental Due Diligence

Building Assessments

Site Investigation & Remediation

Energy Performance & Benchmarking

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Construction Risk Management

Zoning Analysis Reports & ALTA Surveys

4.0 SAMPLING RATIONALE

Sampling of soil and groundwater will be conducted at the conclusion of each remedial phase, except for soil capping, to verify compliance with the cleanup standards in **Tables 3-1a** and **3-1b**. At this time, the groundwater remedy is in the design phase and an Initial Production Task (IPT) will be completed prior to the completion of the full design. This SAP includes the groundwater progress monitoring sampling proposed for the IPT.

4.1 Soil Sampling

Soil removal and disposal (R&D) will occur prior to soil sampling. Soil sample collection will be conducted by AEI field staff. Soil sample results will be used to show compliance with the cleanup standards. Excavation areas and proposed points of compliance are shown on **Figures 1** and **2.** Bottom samples will be collected at the nodes of a 5 foot grid. Sidewall samples are not shown and will be determined in the field by the AEI field staff based upon final excavation area. Sidewall samples will be located so at least one sample per sidewall is collected. Frequency will be 1 sample per every 25 linear feet. For excavations deeper than 4 feet, at least one additional sample will be collected below each shallow sidewall sample. ~~Sidewall samples will be collected every 4 fee in depth.~~ **Table 4-1** provides information regarding the sample designation, proposed sample depths, sample/duplicate/QC rationale. Sidewall sample depths are to be determined based upon final excavation extents.

4.2 Sediment Sampling

Not applicable to this scope of work

4.3 Groundwater Sampling

An IPT will be performed as part of the groundwater treatment pilot study. Following the IPT, progress monitoring of the VOC contamination in site groundwater will be conducted by AEI. Deep and shallow groundwater will be evaluated using existing on-Site wells. The proposed compliance wells are shown on **Figure 3**. **Table 4-2** provides sample designation, sample depth, sample locations/duplicate information.

4.4 Other Sampling

Samples for disposal characterization purposes may need to be collected during the course of work. Frequency of sampling will be specified by the selected disposal facility, but for this project it is anticipated the required sample frequency will be one (1) sample for every 500 tons of material. When collecting soil samples for disposal purposes, the disposal parameters for approval shall be used as the analytical requirements. These analyses may include: VOCs, PCBs, SVOCs, TPH, RCRA 8 Metals, Reactivity, Ignitability, Paint Filter, and Total Cyanide and Sulfur.

Table 4-1: Soil Sampling Design and Rationale

Sampling Location/ID Number	Depth (ft)	Analytical Parameter	Rationale
Bottom Samples			
B-1	1	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-2	1	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-3	1	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-4	1	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-5	3	PCBs (9078, 8082A)~~PCBs (9078)~~	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-6	3	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-7	3	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-8	3	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-9	3	PCBs (9078~~, 8082A~~)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-10	3	PCBs (9078, 8082A)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-11	3	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-12	3	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-13	3	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-14	3	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-15	3	PCBs (9078, 8082A)~~PCBs (9078)~~	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-16	3	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.
B-17	3	PCBs (9078)	Post excavation verification of compliance with 25 mg/kg PCB cleanup standard. Sample location in accordance with TSCA.

for each sample. If the results are found to be acceptable, AEI will determine if the use of a multiplier for the field screening results will be necessary to assure that false negatives are eliminated (i.e., soils that actually contain >25 mg/kg aren't identified as <25 mg/kg soils). (See Attachment 3 of the CMI WP for results of the Comparability Study and for the attached SOP developed for use of the Dexsil method).

Once the PCB screening method has been shown to be acceptable for use, it will be employed to show compliance with the 25 mg/kg cleanup level during excavation activities. Areas where the cleanup level is less (i.e., Floodway, where cleanup must achieve < 1 ppm), AEI will utilize laboratory analyses only when the extent of the excavation has been achieved. However, the Dexsil method will also be used in this area during the excavation process to guide the extent of excavation required. For every ten (10) PCB screening samples collected and analyzed by the Dexsil L2000DX PCB/Chloride analyzer, two (2) soil samples will be submitted to the laboratory for PCB analysis via EPA Method 8082A/3540C Soxhlet Extraction to verify the field screening results.

Additionally, field screening for VOCs using PID instrumentation and visual observations will be used by the field team to evaluate and adjust excavation depths and locations as needed, specifically in the areas of SWMU-8 and 11, but in others also, as needed. This approach to the field investigation is a key component of a dynamic CMI.

6.3 Soil

6.3.1 Surface Soil Sampling

Not Applicable, soil samples are to be collected from the final excavations which are greater or equal in depth than 6-12 inches below the ground surface.

6.3.2 Subsurface Soil Sampling

The majority of the soil sampling will be conducted below the ground surface at depths equal to or exceeding 12 inches. Sample depths will be achieved through contaminated soil removal as designed in the CMI WP. Refer to Section B.2.2 in the QAPP for soil sampling SOPs. The locations, except for sidewall samples, and sample designations are shown on **Figures 1** and **2** and the rationale given in **Table 4-1**.

Samples to be analyzed for VOCs will be collected first. Subsurface samples will be collected by hand at the desired sample depth once soil removal is complete. Once the desired sample depth is reached, soil samples for VOC analyses will be collected as independent, discrete samples. The top 6-inches of soil should be removed to encounter an "undisturbed" layer. Surface soil samples will be collected using the laboratory supplied Encore sampler, and will be collected in triplicate (one high-level and two low-level VOAs). Samples will be placed, sealed and properly stored in the pre-preserved laboratory sample jars. See Section 7.1 for shipping procedures.

Subsurface samples will be collected by manual methods (i.e., trowel) to the desired sample depth. Once the desired sample depth is reached, the AEI field staff, will collect a sample from the sidewall and bottom of the excavations. Sidewall samples will be collected as composites from the bottom to the top of the sidewall from depths of 0 to 4 ft bgs and from 4 to 8 ft bgs (or less), as necessary. AEI field staff are not to enter an excavation deeper than 4-feet and

8.0 DISPOSAL OF RESIDUAL MATERIALS

In the process of collecting environmental samples, the sampling team will generate different types of potentially contaminated IDW that include the following:

- Used personal protective equipment (PPE)
- Disposable sampling equipment
- Decontamination fluids
- Purged groundwater and excess groundwater collected for sample container filling

The EPA's National Contingency Plan (NCP) requires that management of IDW generated during sampling comply with all applicable or relevant and appropriate requirements (ARARs) to the extent practicable. In addition, other legal and practical considerations that may affect the handling of IDW will be considered.

- Used PPE and disposable equipment that does not come into contact with PCB-impacted soils will be double bagged and placed in a municipal refuse dumpster. These wastes are not considered hazardous and can be sent to a municipal landfill. Any PPE and disposable equipment that is to be disposed of which can still be reused will be rendered inoperable before disposal in the refuse dumpster. If PPE comes into contact with PCB soils, then disposal shall include placing the materials into 55-gallon drums and dispose of according to TSCA disposal regulations.

- Decontamination fluids that will be generated in the sampling event will consist of pesticide-grade solvent, deionized water, residual contaminants, and water with non-phosphate detergent. The volume and concentration of the decontamination fluid will be sufficiently low to allow disposal at the site or sampling area. The water (and water with detergent) will be poured onto the ground if it contains less than 0.5 ug/l PCBs~~or into a storm drain~~. Pesticide-grade solvents will be disposed of according to TSCA disposal regulations.~~allowed to evaporate from the decontamination bucket~~.

- Purged groundwater will be landscaped should screening using a PID exhibit total VOC concentrations below 5.0 ppm. Otherwise, the purged water will be placed into a 55-gallon drum for disposal as non-hazardous liquid waste.

ATTACHMENT 3

Revised Dexsil Method Standard Operating Procedure

MEMORANDUM

TO: Frank Battaglia and Kim Tisa, EPA

FROM: AEI Consultants

SUBJECT: BASF Corporation
Former Ciba-Geigy Facility
Lot 1102, 180 Mill Street, Cranston, Rhode Island
PCB Analysis Using Dexsil Method Standard Operating Procedure-Revised

DATE: April 27, 2018

INTRODUCTION AND PURPOSE

AEI Consultants (AEI) has prepared this technical memorandum to present the Standard Operating Procedure (SOP) for the use of the PCB screening tool, Dexsil L2000DX PCB/Chloride analyzer, for the upcoming remedial effort at the above referenced Site. The goal is to uniformly use the Dexsil analyzer as a quantification method, in conjunction with a subset of traditional laboratory analysis via EPA Method 8082A/3450C Soxhlet Extraction, to quantify the in-situ PCB concentrations and demonstrate compliance with TSCA (40 CFR 761.61(c)) and RIDEM Remediation Regulation (DEM-DSR-01-93) post-excavation cleanup standards. This SOP incorporates the results of a PCB Analysis Comparability Study previously submitted to EPA on December 5, 2017 with subsequent comments by EPA.

COMPARABILITY STUDY RESULTS/RECOMMENDATIONS

As detailed in Section 6.2 of the Sampling and Analysis Plan (SAP), submitted to EPA and RIDEM as Appendix F of the Corrective Measures Implementation Work Plan on September 8, 2017, AEI collected representative soil samples from Lot 1102 and from a soil stockpile as part of a PCB Data Comparability Study. The objective of the study was to design the protocol for post-excavation verification sampling analysis using a combination of field-screening using an EPA-approved field extraction and analysis technology (EPA Method 9078, called Dexsil herein) and laboratory analytical data. The SOP considers the Site's two remedial action objective metrics:

1. The 25 mg/kg metric where site soils will be uniformly remediated to below 25 mg/kg.
2. The 10 mg/kg metric; soils remaining above this metric and subject to potential infiltration from precipitation must be covered with an impermeable HDPE liner, and the Site's post-excavation 95% Upper Confidence Level (UCL) PCB concentration must be < 10 mg/kg.

The Dexsil results were evaluated against laboratory data to determine how the Dexsil data should be used in making field decisions. The evaluation included a regression analysis and calculation of the relative percent difference (RPD) for each sample. AEI determined whether the use of a

multiplier for the field screening results would be necessary to ensure that false negatives are eliminated (i.e., soils that actually contain either >25 mg/kg or >10 mg/kg are not identified as either <25 mg/kg or <10 mg/kg, respectively).

The comparison study showed the following:

1. While on average the Dexsil overpredicted the actual concentrations, the screening results were susceptible to underprediction within the 3 mg/kg to 30 mg/kg range.
2. The correlation for concentrations greater than 10 mg/kg was excellent (R2 = 0.99), however, for concentrations ≤ 20 mg/kg the correlation was degraded.
3. The correlation for concentrations less than 10 mg/kg was marginal (R2 = 0.22), however, the Dexsil was generally biased high (8 of 11 results).

Given these observations, the conclusion is that the Dexsil analyzer can be used for post-excavation verification sampling analysis with the following condition intended to eliminate possible false negatives of the 10 mg/kg and 25 mg/kg metrics:

- Use a conservative multiplier of 2.0 for the Dexsil data, ie., a reading of 5 mg/kg on the Dexsil will be converted to 10 mg/kg.

In accordance with the Field Sampling Plan in the CMI (Appendix F) for every fifth Dexsil sample taken (i.e., 20% frequency), a duplicate sample will be submitted for laboratory analysis using EPA Method 8082/3540.

PROPOSED USE OF THE DEXSIL METHOD

AEI proposes to use the Dexsil analyzer for determining PCB concentrations in soils during the excavation process and post-excavation to confirm that the site-specific PCB Media Protection Standard has been achieved. All Dexsil results less than 30 mg/kg will initially be multiplied by a factor of 2.0. As described below, during the initial phase of project implementation, AEI will collect data to refine the scale of the correction factor and adjust it as appropriate with approval by the EPA.

The Dexsil analyzer will not be used to characterize soils for disposal characterization purposes. The Dexsil analyzer will also not be used to determine post-excavation PCB concentrations within the Floodway where <1 mg/kg must be achieved. However, it may be used during the excavation process in the Floodway to determine when it is appropriate to collect post-excavation samples for laboratory analyses.

When using the Dexsil during the excavation of an area with PCB concentrations ≥50 mg/kg, all soils identified with concentrations ≥25 mg/kg (after application of the correction factor) will be disposed as ≥50 mg/kg PCB remediation waste.

COMPARABILITY STUDY ADDENDUM

AEI will complete an additional study to supplement the existing data, specifically within the 3 to 30 mg/kg range, to refine the scale of the multiplier. This will be accomplished during the completion of the first excavation area on the Site. AEI will collect duplicate samples for laboratory analysis from each location with a result of 30 mg/kg or less (without the application of the correction factor). A minimum of 9 duplicate samples will be collected. AEI will determine the relative percent difference (positive or negative) for each sample and recalculate a correlation coefficient using all the data collected during both studies. Based on the results, AEI will present recommendations for altering the correction factor, as appropriate, for EPA approval.

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